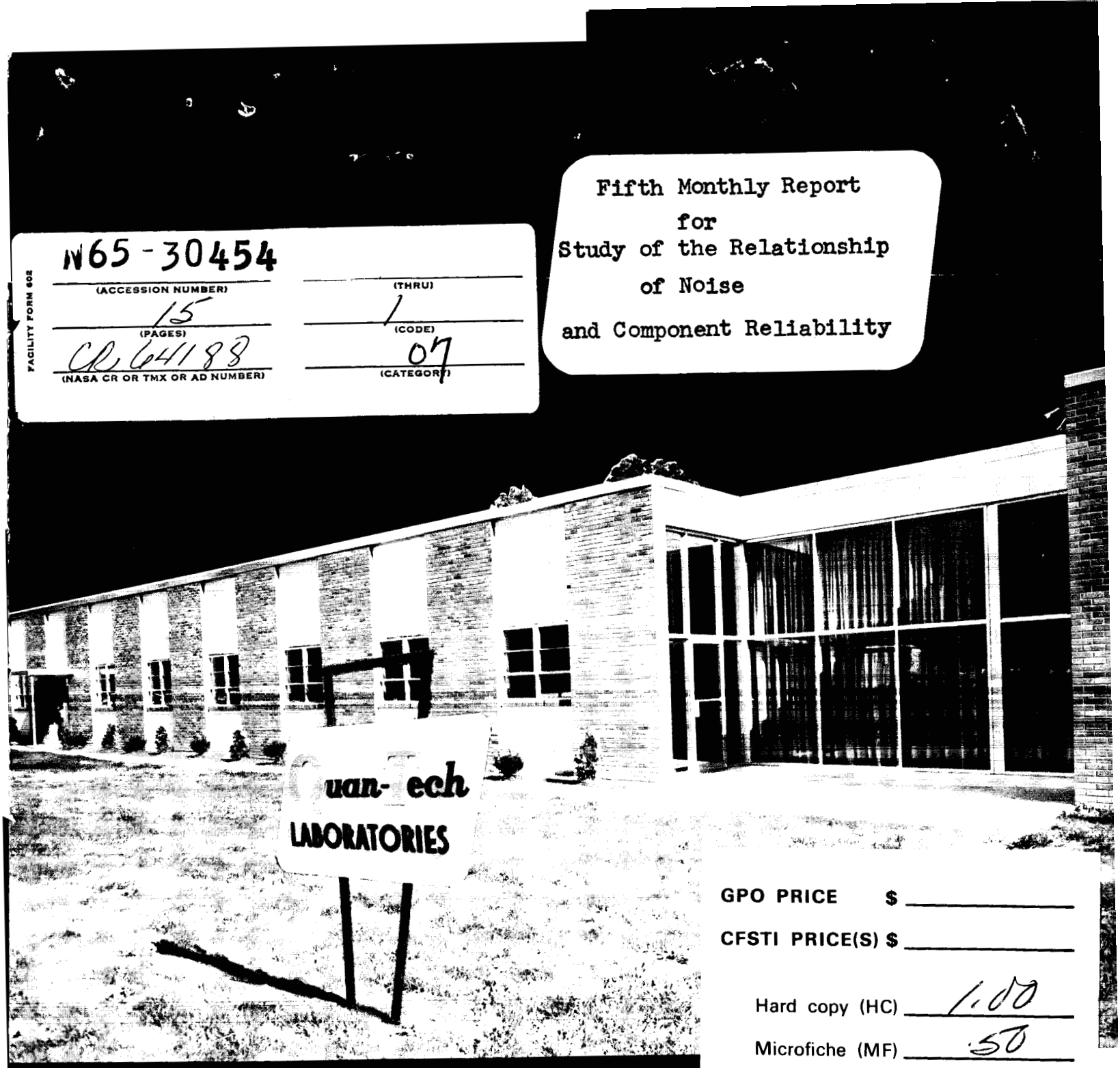
N65-30454
(ACCESSION NUMBER)
15
(PAGES)
CR 64188
(NASA CR OR TMX OR AD NUMBER)
1
(THRU)
(CODE)
07
(CATEGORY)
FACILITY FORM 602

Fifth Monthly Report for Study of the Relationship of Noise and Component Reliability



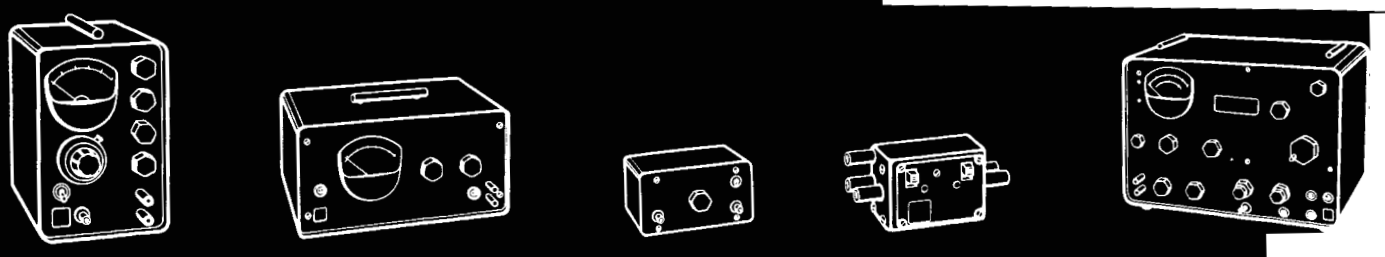
GPO PRICE $ _____

CFSTI PRICE(S) $ _____

Hard copy (HC) 1.00

Microfiche (MF) .50

ff 653 July 65



INSTRUMENTS • AMPLIFIERS • NOISE INSTRUMENTATION

Fifth Monthly Report

for

Study of the Relationship of Noise and Component Reliability

(1 June, 1965 - 1 July, 1965)

Contract No. NAS5-9550

Prepared by

Quan-Tech Laboratories, Inc.
Whippany, N.J.

for

Goddard Space Flight Center

Greenbelt, Maryland

Study of the Relationship of Noise and Component Reliability

1.1 Objective of study program.

A component which differs greatly from the norm or the rest of it's family in any parameter must be considered a reliability risk.

The above statement is well accepted, since such components are abnormal due to an irregularity or defect.

The purpose of this study program is to determine which type or types of noise measurement is the most effective screening tool for detecting defective transistors and to establish a "cull" line or screening level for this measurement. Data obtained from the study will be used to determine the relationship between noise and component reliability as stated above, and where possible to determine the nature of the defects in abnormal transistors.

2.1 Work Performed.

Noise screening of the 3000 transistors was completed. The time required for the noise measurements was somewhat greater than was initially planned, since a 10cps measurement was added to the 100cps and 1000cps measurements.

The resulting data from the noise measurements was analyzed. Histograms of both tests A (I_c = 100 ua, V_{ce} = 50 volts, Rg = 10K) and B (I_c = 30 ma, V_{ce} = 10V, Rg = 0) were plotted for each box of 100 transistors. Since the transistors were coded by the manufacturer with codes Q and N, a composite histogram of each code type was made. No detectable difference was noted, thus it was assumed that the entire 3000 transistors was a reasonable sample.

A preliminary cross plot of test A vs. test B for the 10cps measurements was made. Copies of the available data and graphs were delivered to Mr. Stambach at NASA on June 17. At the same time the selection approach for the 500 units to be life tested was reviewed. M. Townsen, J. Hixson, G. Stambach, of NASA; R. Struble and A. Stansbury of QTL were present.

A correction of the cross plot of test A vs. test B was made due to several plotting errors in the preliminary cross plot. This plot is attached, as well as histograms

2.1 Work Performed (Cont'd)

of tests A and B. The selection of the transistors to be life tested was made in accordance with the following steps:

1. Select all transistors from "boxes" found in the 120 and 130 nanovolt columns of Test B and all in the 1200 and 1300 nanovolt columns of Test A.

2. In all remaining "boxes" select three transistors plus a weighting quantity. The weighting quantity is determined by dividing the number of transistors in each "box" by twenty and rounding off to the nearest multiple of three. This number of transistors is then added to the initial three to make up the total sample from a "box".

3. Using a table of random numbers to determine the first transistor to be selected from a "box", select every n^{th} transistor until the sample quantity is complete. Where n = total number of transistors in a "box" divided by the number to be selected.

4. Number all transistors selected in the following sequence: 1, 2, 3, 1, 2, 3, 1, 2, 3, 4. Transistors numbered 1 are in the first test group; 2 in the second; 3 and 4 in the third. Thus the groups consist of 150, 150, and 200 transistors.

5. Mount transistors of each group on test boards (containing 5 each). Again using random numbers, assign board numbers.

The transistors of Group 1 were measured for all test parameters, i.e. I_{cbo}, I_{ebo}, h_{fe}, noise tests A and B, and base emitter breakdown. Photographs were taken of all units showing irregular breakdown. The random sampling resulted in a reasonable distribution of irregular units.

The life test facility was made ready to start as early in July as possible.

3.1 Progress of the contract is in conformance with the schedule.

4.1 The graphical analysis of the noise data of the 3000 transistors indicated that there was little difference between them and the first lot of 100 units obtained for manufacturer selection. It is interesting to note that test B had a wider distribution than test A. Past experience with germanium transistors has shown the reverse of this. All indications are favorable for a successful program.

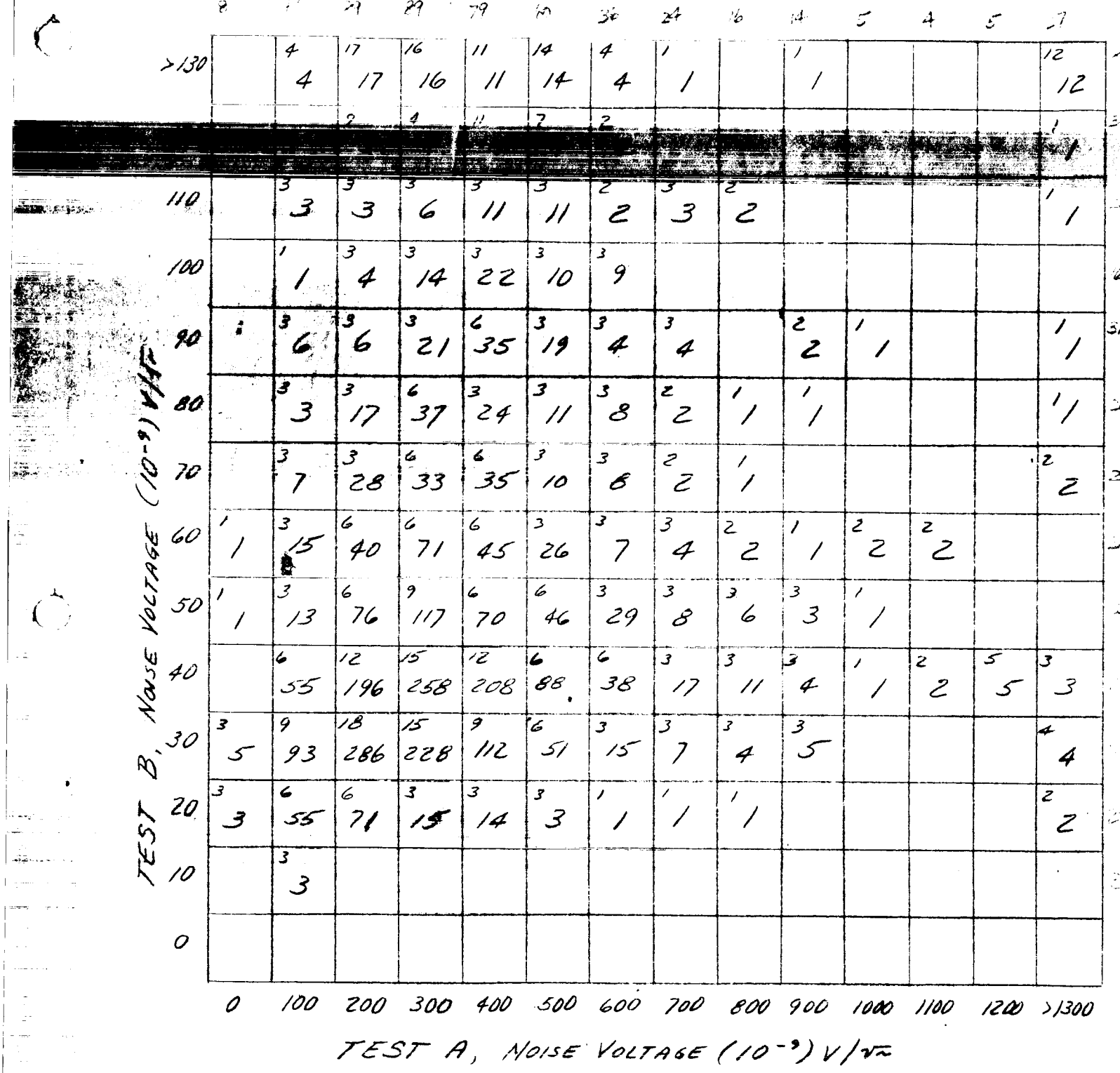
5.1 All measurements and data are cross-checked to insure reliability.

6.1 With the progress payments agreed upon, funds are fully adequate to complete the task.

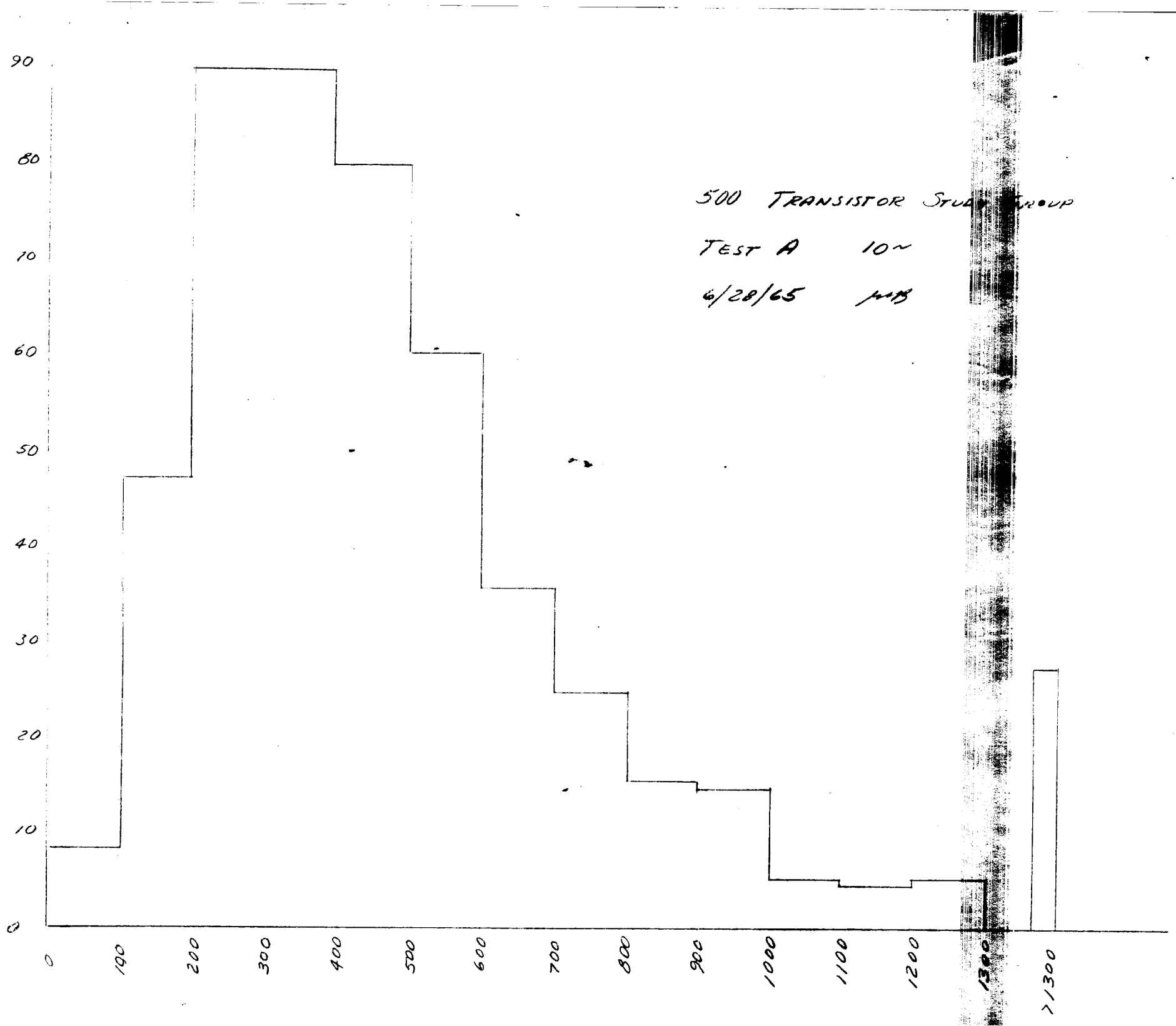
7.1 There are no significant changes in the Company's operating personnel.

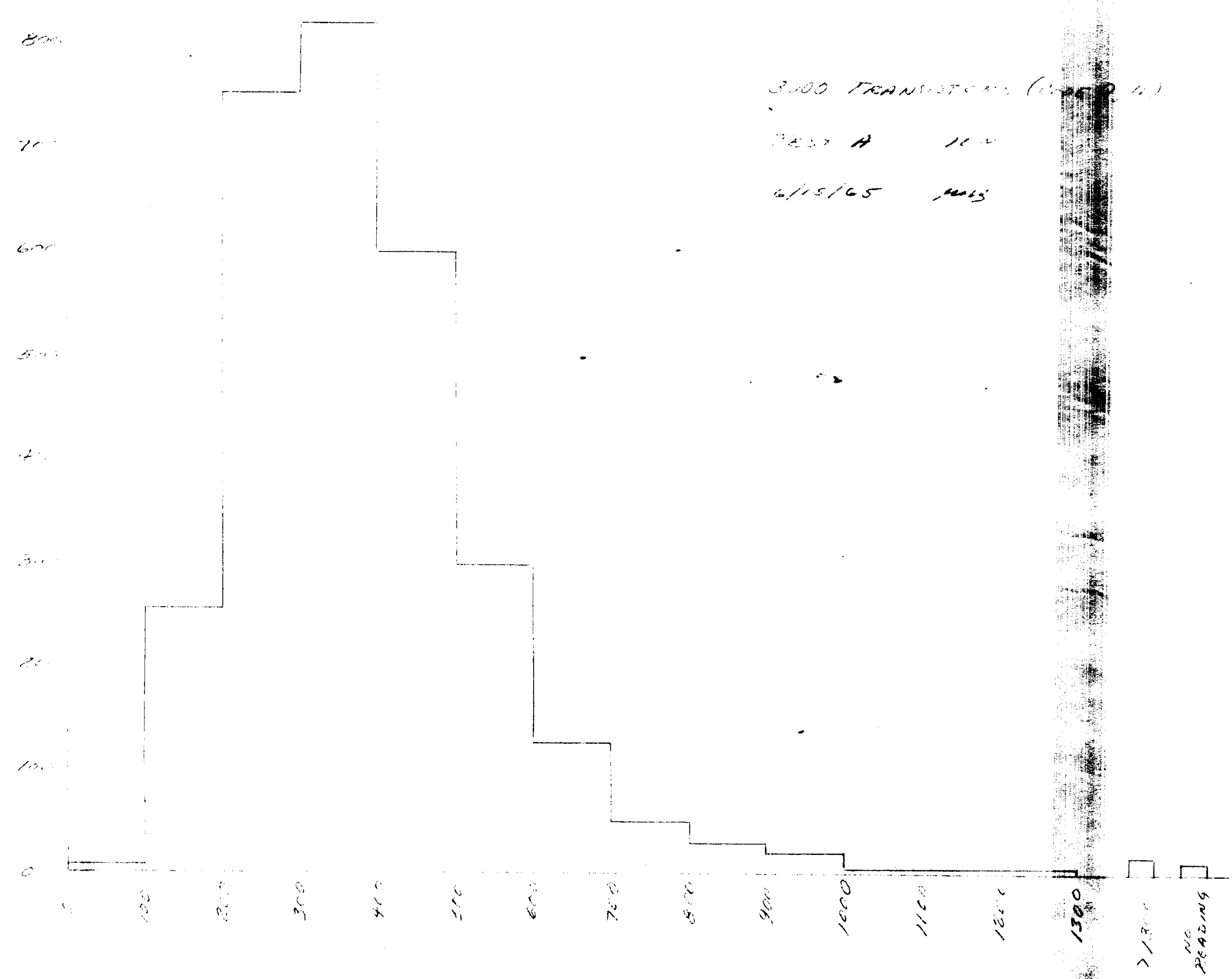
8.1 Work Schedule for July

The life testing of the 500 selected transistors will be started during the month in staggered groups. Analysis of data obtained during the life test will be started as soon as it is available. Complete data will not be available until the first week of September.

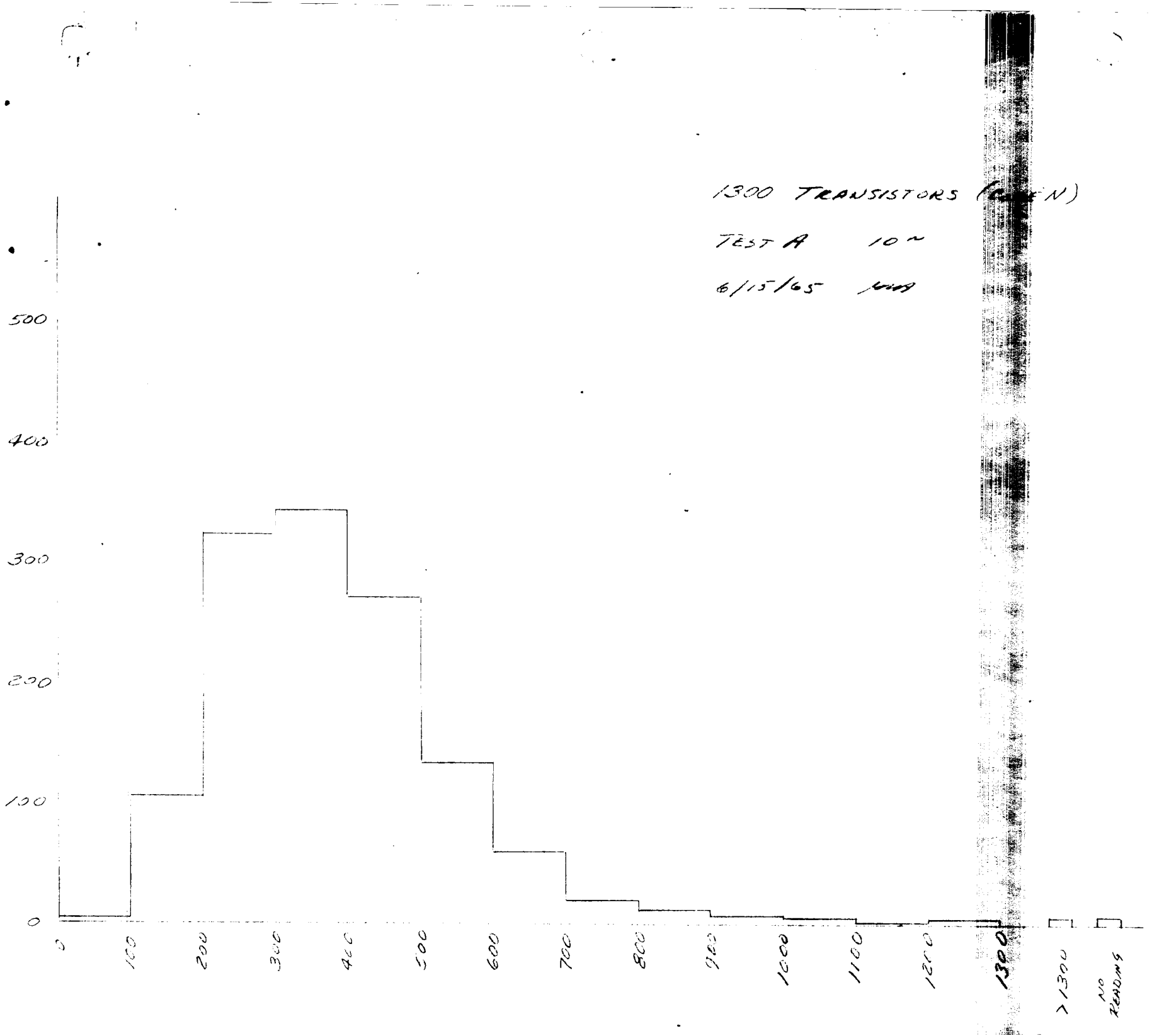


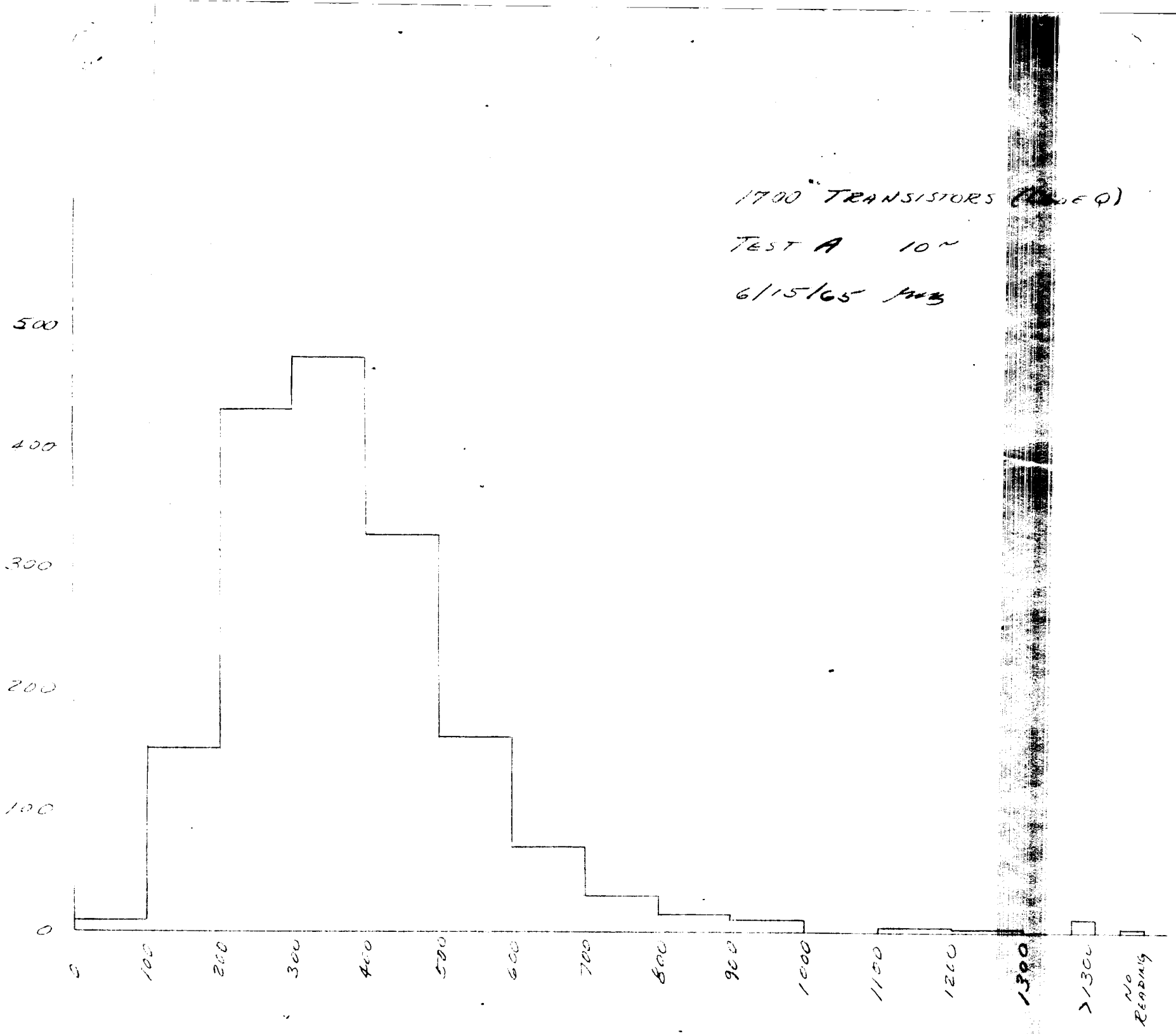
CROSS PLOT OF 10 C.P.S. TESTS SHOWING TOTAL 3000 TRANSISTORS AND 500 UNITS SELECTED FOR STUDY

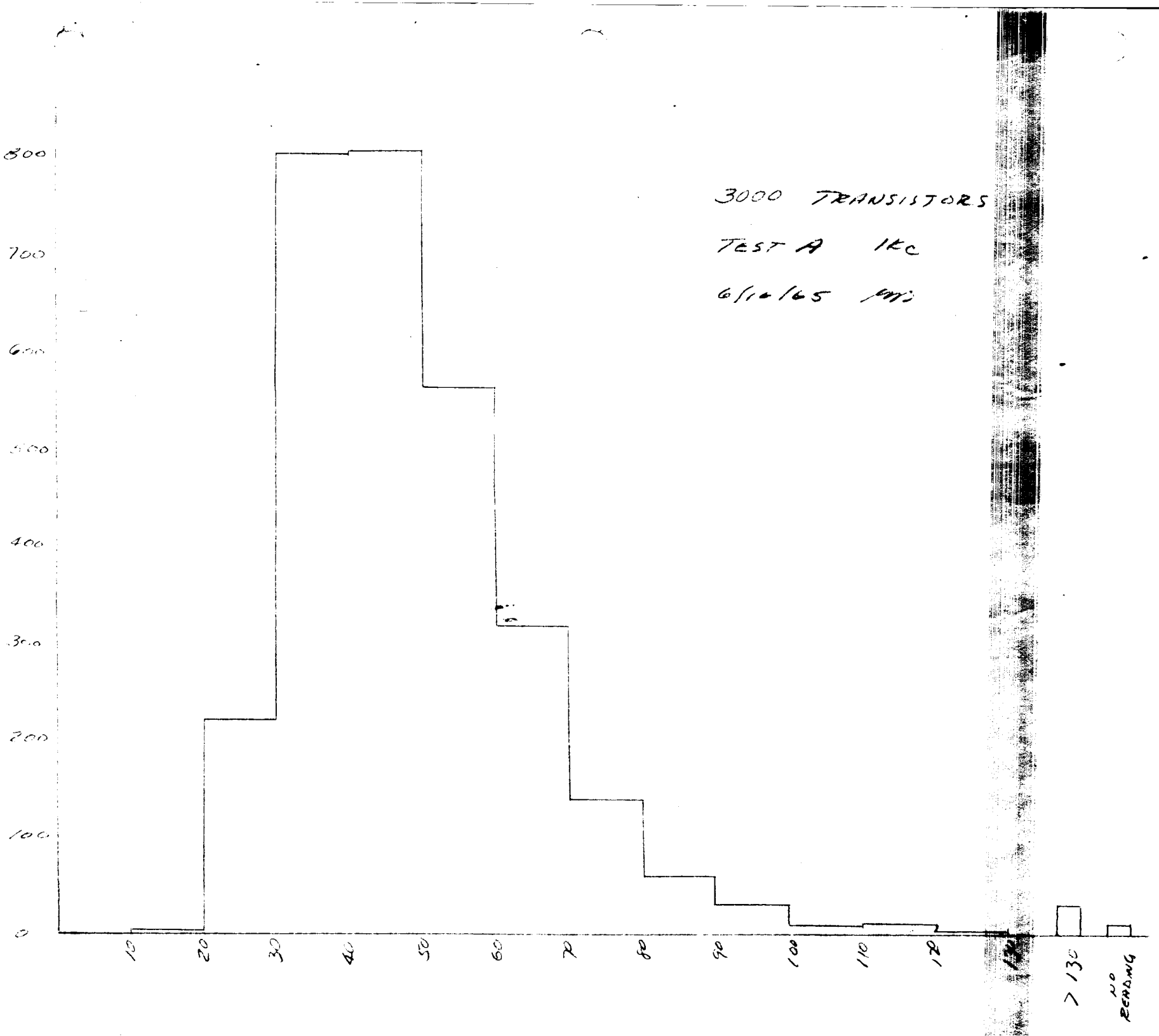

500 TRANSISTOR STUD
TEST A 10~
6/28/65
90
80
70
60
50
40
30
20
10
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
>1300

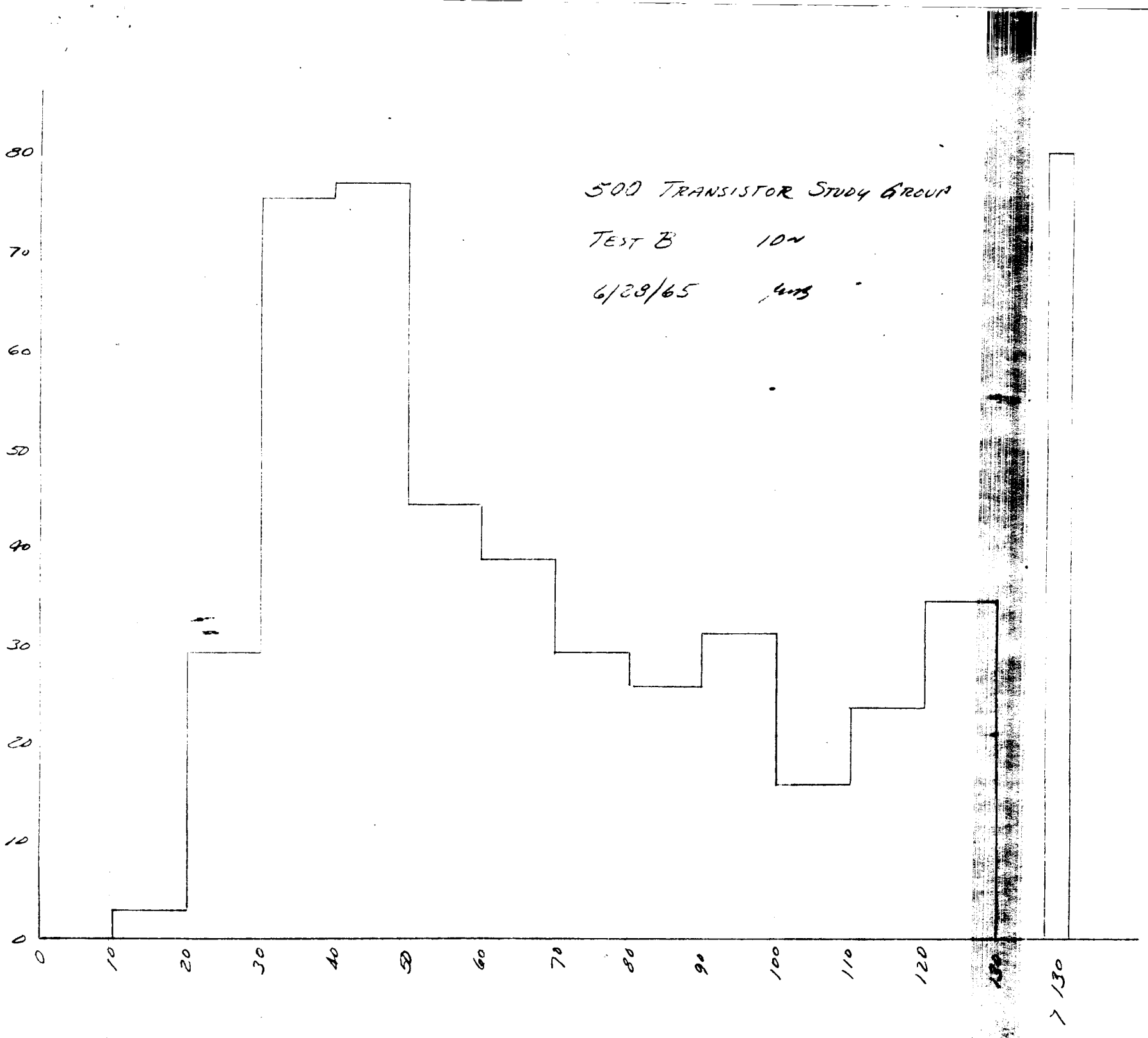


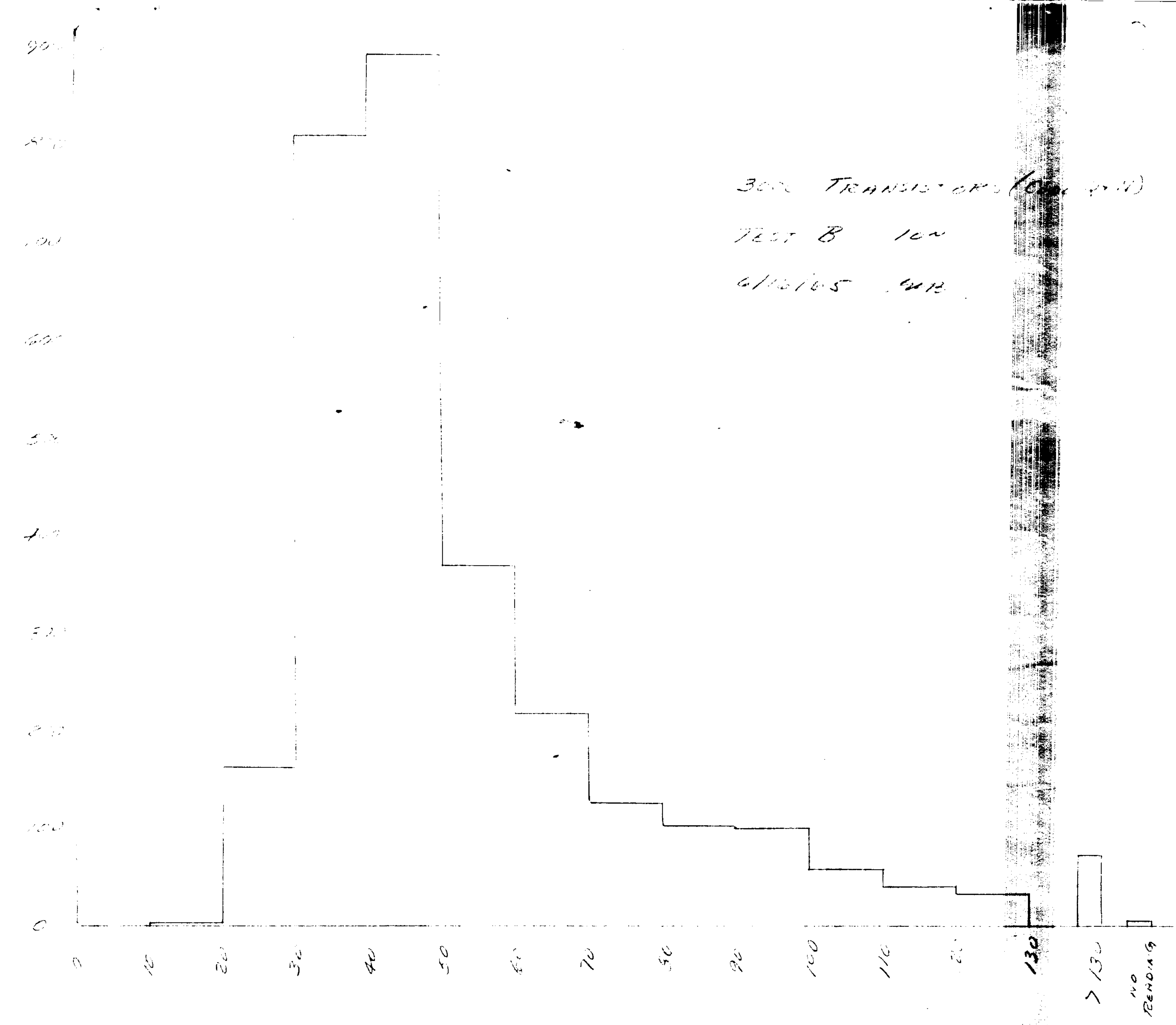
3300 TRANSISTORS
TEST A
6/15/65
800
600
0
300
400
600
720
900
1000
1100
1300
NO READING

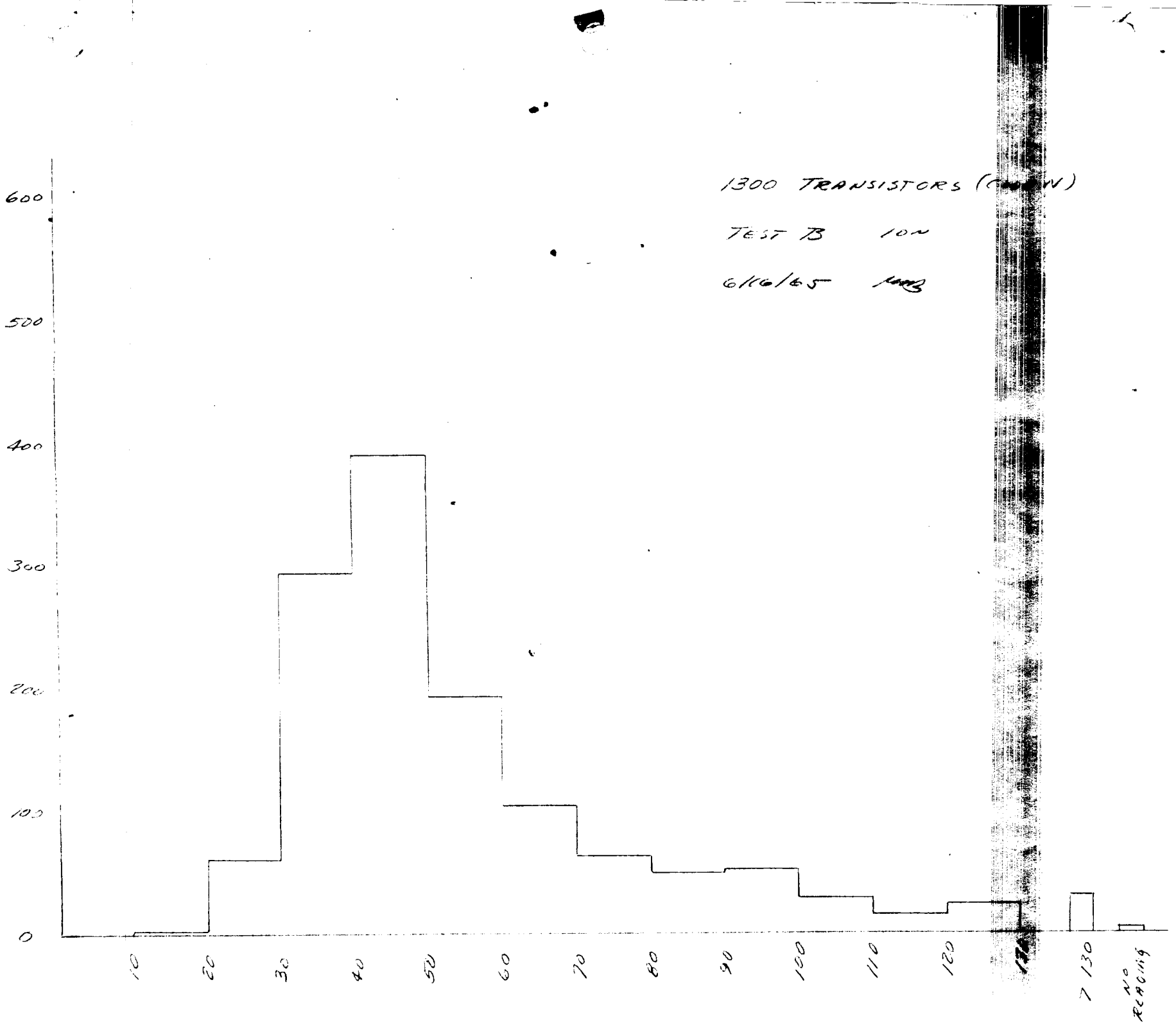

1300 TRANSISTORS (
TEST A 10 ~
6/15/65
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
>1300
NO READING


1700 TRANSISTORS
TEST A 10~
6/15/65
500
400
300
200
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
>1300
NO READING

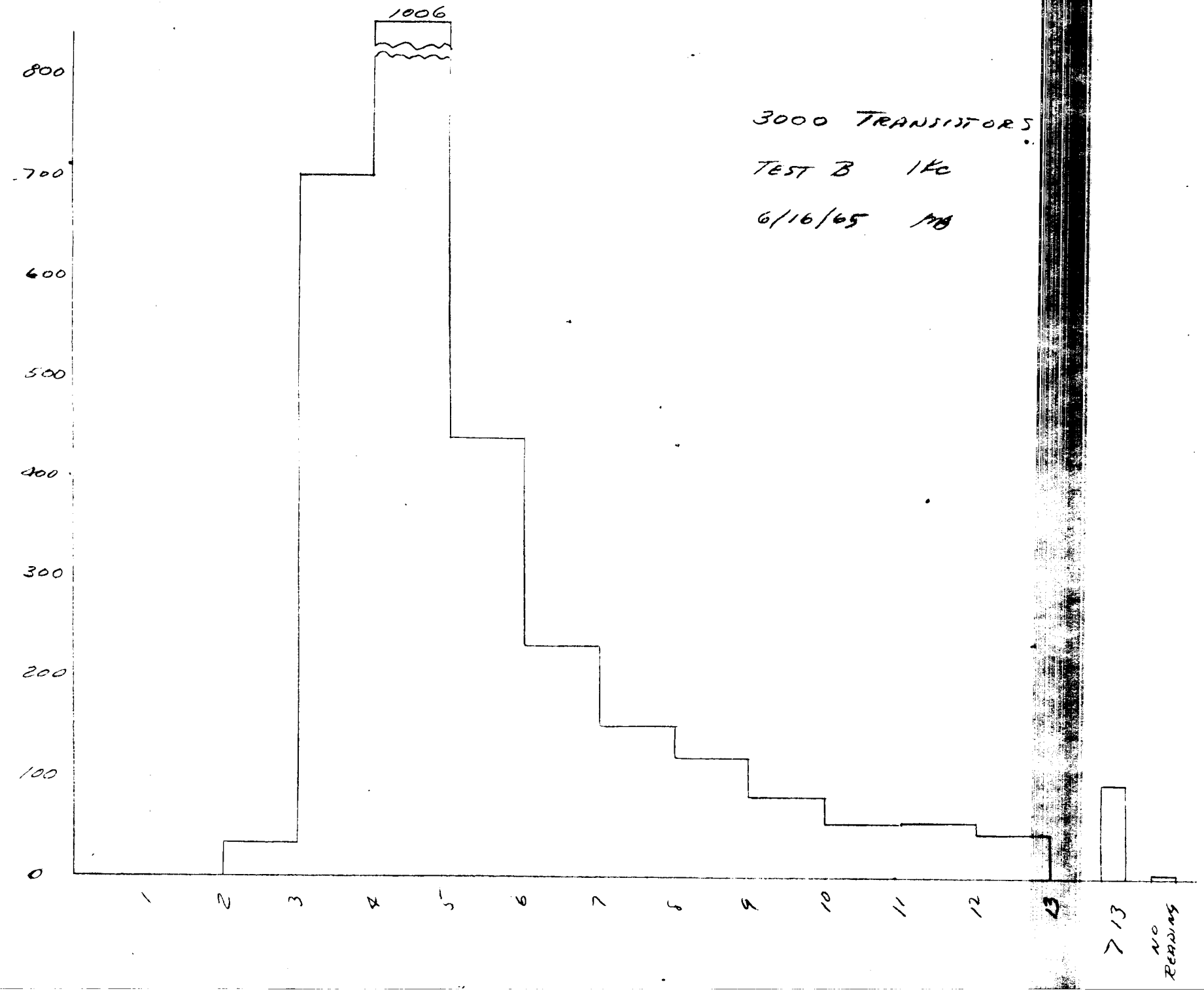

800
700
600
500
400
300
200
100
0
3000 TRANSISTORS
TEST A ltc
6/16/65 mj
10
20
30
40
50
60
70
80
90
100
110
120
> 130
NO BENDING


500 TRANSISTOR STUDY GROUP
TEST B
10V
6/29/65
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
110
120
130
> 130


TEST B
0
10
20
30
40
50
70
80
90
100
110
130
> 130
NO READING


1300 TRANSISTORS (
TEST B 10V
6/16/65
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
110
120
> 130
NO READING

NO READING
120
110
100
90
80
70
60
50
40
30
20
10
0
100
200
300
400
500


1006
800
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
10
11
12
13
>13
NO READING
3000 TRANSISTORS
TEST B 1Kc
6/16/65 MB